LIGHTCURVE ANALYSIS OF 216 KLEOPATRA

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CCD images (I_c filter) of the asteroid 216 Kleopatra were obtained over four sessions from 2017 August to September. A folded lightcurve was produced and the synodic period, P = 5.3856 h, was calculated.

Minor planet 216 Kleopatra is an M-type member of the main belt that was discovered by J. Palisa in 1880. It provides an interesting target for study due to its dumbbell shape, 217 km x 94 km x 71 km (Ostro *et al*., 2000), which can result in a large lightcurve (LC) amplitude suitable for investigation by telescopes with a modest aperture. In this case the minimum to maximum peak amplitude of A = 0.48 mag was near the middle of the range of 0.12-1.22 mag typically observed for this system.

The equipment used at UnderOak Observatory included a focal reduced (*f*/6.42) 0.28-m Schmidt-Cassegrain telescope with a thermoelectrically cooled SBIG ST-8XME CCD camera. A total of 469 images were taken over four sessions from 2017 August 6 to September 11. Light frames were taken through an I_c filter using 75-s exposures, during which the CCD camera was operated between –5 and –10 °C.

Image acquisition (raw lights, darks, flats) was performed with *TheSkyX Pro* while calibration and registration was performed with *AIP4WIN* (Berry and Burnell, 2006). Further data reduction was carried out with *MPO Canopus* (Warner, 2008) using at least two non-varying comparison stars to generate lightcurves by differential aperture photometry. Data were light-time corrected but not reduced to standard magnitudes.

Table I summarizes the observational parameters and results. *MPO Canopus* provided a period solution for the folded data sets using Fourier analysis (FALC; Harris et al., 1989). The calculated synodic period of 5.3856 ± 0.0001 h is generally in good agreement with the most recently published rotational periods (Alton, 2009; Kaasalainen and Viikinkoski, 2012; Shevchenko et al., 2014) as well as with other unpublished lightcurve data (2010, 2015 and 2017) referenced at the JPL Solar System Dynamics website (*http://ssd.jpl.nasa.gov/sbdb.cgi*).

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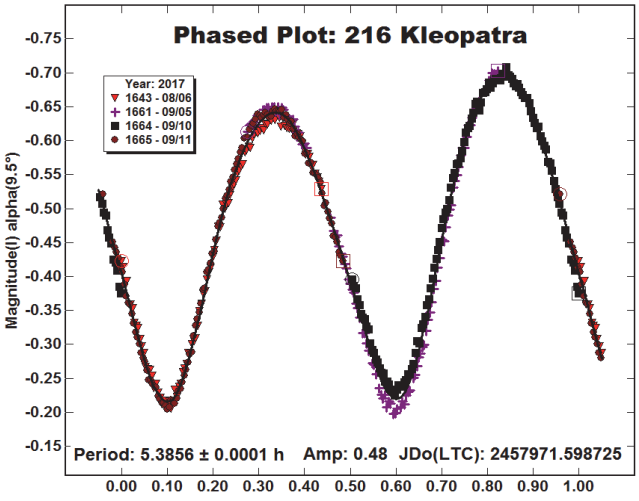

Number	Name	2017 mm/dd	Pts	Phase	L_{PAB}	B_{PAB}	Period(h)	P.E.	Amp	A.E.	Grp
216	Kleopatra	08/06-09/11	469	9.5-19.2	303	16	5.3856	0.0001	0.48	0.02	MB-O

Table I. Observing circumstances and results. Pts is the number of data points. The phase angle is given for the first and last date. L_{PAB} and B_{PAB} are the approximate phase angle bisector longitude and latitude at mid-date range (see Harris *et al.*, 1984). Grp is the asteroid family/group (Warner *et al.*, 2009).